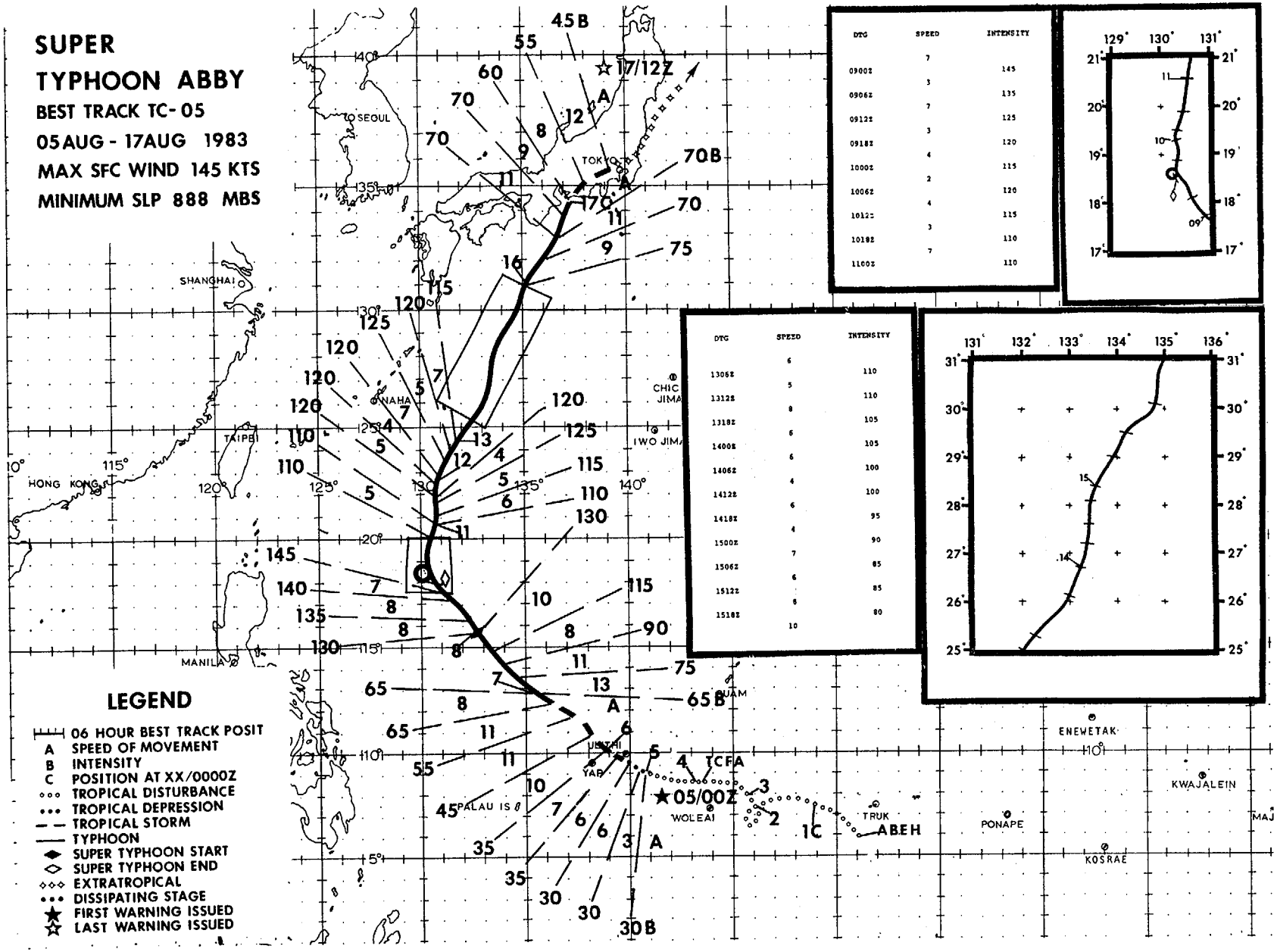

SUPER
TYPHOON ABBY
BEST TRACK TC-05
05AUG - 17AUG 1983
MAX SFC WIND 145 KTS
MINIMUM SLP 888 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
DTG SPEED INTENSITY
0900Z 7 145
0906Z 3 135
0912Z 7 125
0918Z 3 120
1000Z 4 115
1006Z 2 120
1012Z 4 115
1018Z 3 110
1100Z 7 110
DTG SPEED INTENSITY
1306Z 6 110
1312Z 5 110
1318Z 8 105
1400Z 6 105
1406Z 6 100
1412Z 4 100
1418Z 6 95
1500Z 4 90
1506Z 7 85
1512Z 6 85
1518Z 8 80
10 80
17/12Z
05/00Z
JTWC
SEOUL
TOKYO
SHANGHAI
NAHA
TAIPEI
HONG KONG
CHICHI JIMA
IWO JIMA
MANILA
GUAM
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN

The tropical disturbance which eventually developed into the second super typhoon of the season was first detected on satellite imagery on 31 July as an area of enhanced convective activity to the southeast of Guam. This disturbance was located near 6N 152E in close proximity to an upper-level anticyclone. Surface data indicated that a weak surface circulation was centered approximately three degrees to the north of the area of convection. Over the next nine days, this circulation developed into an intense super typhoon with maximum sustained winds of 145 kt (75 m/s) and a massive circulation which was the dominant synoptic feature in the western Pacific. Abby's huge circulation system provided the environment for the development of a second tropical system (Tropical Storm Ben), and eventually caused the dissipation of Ben and another tropical storm (Carmen).

The first four days of Abby's development were unimpressive. The disturbance was monitored closely during this period as it moved slowly westward south of Guam. Although diurnal variations in the convective pattern associated with the disturbance made it appear at times that the system was becoming better organized, no consistent increase in organization was apparent until 3 August.

At 2300Z on 3 August, a TCFA was issued for an area to the south-southwest of Guam based on the consistent increase in organization of the system observed on satellite imagery. A weather reconnaissance aircraft was launched soon after the TCFA was issued, but it was unable to close off a surface circulation even though several hours were spent investigating the suspect area. The mission did succeed in locating a circulation at flight level (1500 ft - 457 m), and at the 700 mb level.

The second aircraft reconnaissance mission was able to close off a surface circulation the following morning at 050034Z. Maximum sustained winds observed were 30 kt (15 m/s) and the MSLP was 1004 mb. On the basis of this report, the first warning was issued on the system as a tropical depression. The forecast called for continued movement towards the west-northwest with slow intensification.

Initial expectations proved reliable for the first 24 hours in warning status. The system was upgraded to a tropical storm at 050600Z on the basis of an increase in convective organization apparent from satellite imagery. At 060000Z Abby's intensity and position were close to forecast expectations.

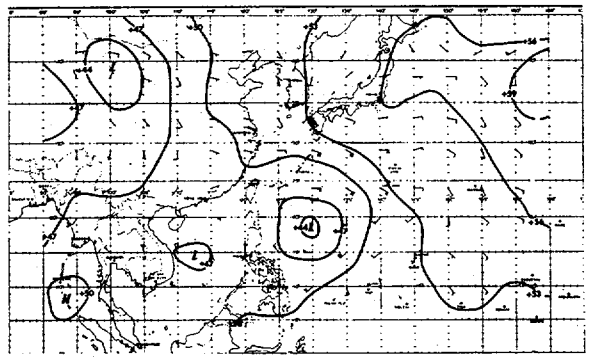
Figure 3-05-1. Super Typhoon Abby near maximum intensity (090946Z August DMSP infrared imagery).

Abby started to move on a more northwestward track after 060000Z, even though all JTWC forecast aids were indicating west-northwestward movement. This was a problem that persisted for the next 11 days. Abby continually tracked to the right of JTWC forecasts even though the forecast aids and numerical progs were all consistently in good agreement on a west-northwestward track for Abby.

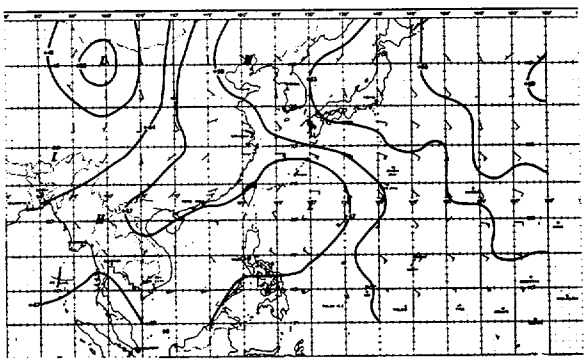
Intensity forecasting also proved to be difficult. Initial expectations were quite accurate for the first 48 hours in warning status. As expected, Abby was upgraded to typhoon at 061800Z when satellite imagery indicated the presence of a weakness in the central dense overcast. The presence of an eye and the accuracy of the intensity estimate by satellite were confirmed five hours later by reconnaissance aircraft reports of 65 kt (33 m/s) winds and MSLP of 973 mb.

On the 7th of August, Abby began to intensify rapidly, far exceeding initial forecast expectations. Reconnaissance aircraft at 071141Z reported a MSLP of 946 mb, a decrease of 27 mb in approximately 12 hours. Other data (MSLP and equivalent potential temperature relationships (Dunnavan, 1981)) collected on the aircraft reconnaissance mission indicated that Abby was about to undergo rapid intensification. The 071200Z warning called for continued rapid intensification on the basis of this information. This forecast proved to be accurate as Abby continued to intensify rapidly over the next 30 hours reaching 120 kt (62 m/s) intensity within 12 hours and maximum intensity of 145 kt (75 m/s) at 081800Z. Abby's lowest central pressure was recorded at 082049Z when dropsonde data from reconnaissance aircraft indicated a measurement of 888 mb. Figure 3-05-1 shows Abby near maximum intensity. Except for minor fluctuations, Abby's intensity decreased slowly and steadily from this point on.

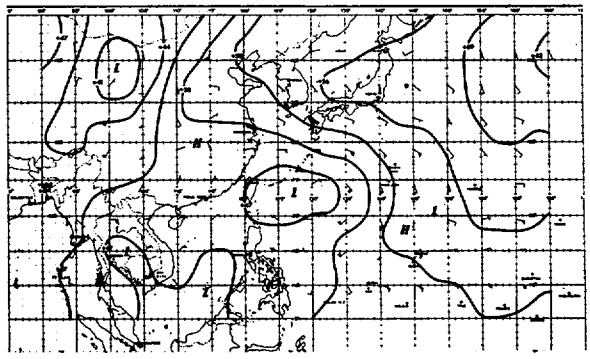
This decrease in intensity was accompanied by a decrease in forward speed as Abby began a slow northward movement for the next two and one-half days. JTWC forecasts for this two and one-half day period called for slow movement to the north followed by a turn to the northwest toward the island of Okinawa. This forecast track was supported by the FLENUMOCEANCEN numerical prog series which indicated that the subtropical ridge over southern Japan would strengthen and induce a northwestward movement. An example



ANALYSIS



24-HOUR PROG



48-HOUR PROG

Figure 3-05-2. FLENUMOCEANCEN prog series for 850 mb at 091200Z August. Note that the subtropical ridge over Japan is forecast to remain as a block to northeastward movement.

of the prog series can be seen in Figure 3-05-2 which depicts the 850 mb prog series for 091200Z.

The intensification of the subtropical ridge over Japan that was consistently forecast in the prog series never occurred. An extensive post-analysis of the height fields over Japan and the islands to the south of Japan indicated that the subtropical ridge weakened continuously in this area over the eight day period following the analysis in Figure 3-05-2.

On the 12th of August, Abby began moving northeastward toward Honshu. Also on the 12th, two other tropical systems developed in the western Pacific; Tropical Storm Carmen (06W) in the South China Sea west of Luzon, and Tropical Storm Ben (07W) to the east of Abby near 26N 146E. The interaction of Abby's outflow with a TUTT cell to the northeast created an area of intense upper-level divergence under which Ben formed. The presence of both of these smaller systems had little effect on Abby, except for drawing some of the inflow away; but in the end, it was Abby which led to the demise of both Ben and Carmen when they became embedded in Abby's massive circulation.

As Abby continued its movement towards the northeast, the forecast emphasis changed from a northwest movement to that of a north-northwest movement towards the island of Kyushu. This forecast track was based on the strengthening of the subtropical ridge to the north and east of Abby; but as stated earlier, the ridge did not strengthen and Abby continued to move toward the northeast and weaken slowly. Aircraft reconnaissance data at 141035Z indicated that Abby's central pressure had risen to 942 mb and that the eyewall was beginning to deteriorate. Abby's intensity fell below 100 kt (51 m/s) at 141800Z for the first time in 7 days.

Abby continued moving to the northeast on the 15th of August with a slight increase in forward speed. Application of an objective technique for predicting acceleration (Weir, 1982) led to a forecast of rapid acceleration to the north through central Japan and extratropical transition over the Sea of Japan. This was based on the expectation that Abby would come under the influence of strong southerly flow in advance of a major trough over northern China. The predicted acceleration never materialized as an upper-level ridge developed over the Sea of Japan to the northwest of Abby (Figure 3-05-3) and effectively blocked this interaction.

Japanese weather radar stations started fixing Abby after 160000Z, with all of the fixes showing continued northeast movement. Data from reconnaissance aircraft, satellite imagery, and synoptic reports indicated that Abby was weakening as it underwent extratropical transition. Abby was downgraded to tropical storm at 170000Z and soon after made landfall near Hamamatsu Japan (WMO 47654). After making landfall, Abby moved eastward following the rugged terrain toward Tokyo, weakening rapidly as it interacted with the mountains. At 171200Z, satellite imagery and synoptic data indicated that Abby had completed extratropical transition, and the final warning by JTWC was issued.

Abby's movement through central Japan caused serious damage over a widespread area. Initial reports indicated that at least two people were killed, 29 others were injured, and one person was missing. The torrential rains generated by Abby resulted in widespread flooding, causing numerous landslides and the destruction of 19 bridges. The heavy rains also severly disrupted road, rail, sea and air service in central Japan.

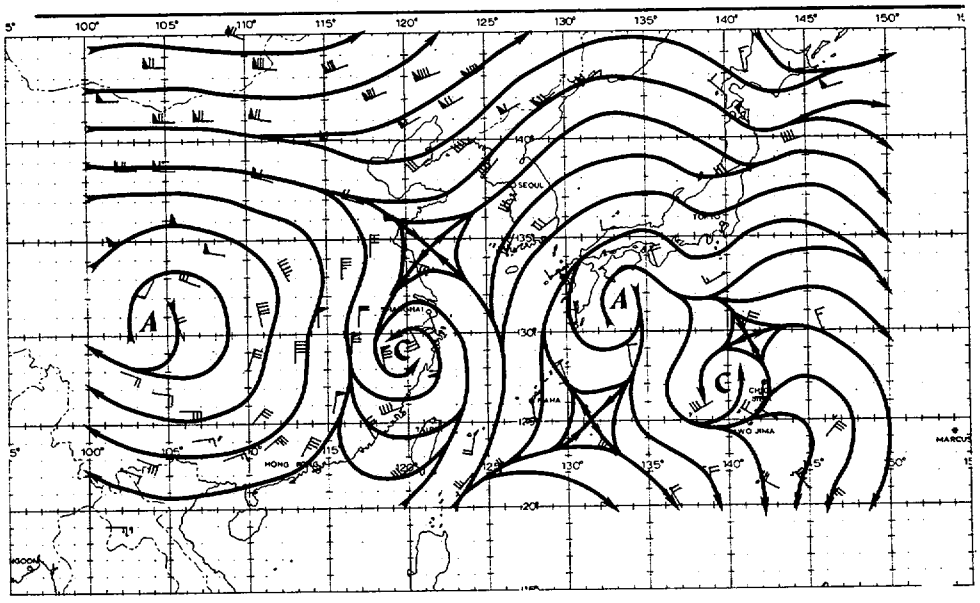


Figure 3-05-3. 200 mb analysis for 170000Z August showing the ridge over the Sea of Japan which prevented Abby from interacting with the westerlies and accelerating northeastward.